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Effects of climatic variability and anomalies on the long term carbon dynamics in a temperate deciduous forest

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Understand the spatiotemporal variability of carbon balance and their controls is important for assessing the vulnerability of the carbon pools in the forest ecosystems under future climate change scenarios. CO₂ exchange over a beech forest near Sorø, Denmark, was measured continuously over the past 13 years (1997-2009). Simultaneous measurements of the environment variables in the atmosphere and soil enable evaluation of the climate impact upon the ecosystem carbon dynamics. Inter-annual variability of net ecosystem exchanges (NEE) of the forest ranges from a source of 32 g m⁻² year⁻¹ in 1998 to a sink of -344 g m⁻² year⁻¹ in 2008. This study aims to investigate the how climatic and phenological anomalies are inter-connected and affect seasonal and inter-annual variations of carbon fluxes. Annual fluxes anomaly are highly correlated with periodical flux anomaly (90 day moving window) during the summer period, which is strongly influenced by summer water stress. Functional change of the ecosystem is also investigated through estimated parameter time series within and between years. The results suggest that combination climate anomalies at different period of years will lead to either an "extreme" ecosystem balance or counterbalance each other, result in an average ecosystem response.